



U.S. Department  
of Transportation  
Federal Highway  
Administration

1200 New Jersey Ave., SE  
Washington, D.C. 20590

December 23, 2015

In Reply Refer To:  
HSST/CC-124

Mr. Barry Stephens  
Trinity Highway Products, LLC  
3617 Cincinnati Ave.  
Rocklin, CA 95677

Dear Mr. Stephens:

This letter is in response to your July 22, 2014 request for the Federal Highway Administration (FHWA) to review a roadside safety device, hardware, or system for eligibility for reimbursement under the Federal-aid highway program. This FHWA letter of eligibility is assigned FHWA control number HSST/CC-124 and is valid until a subsequent letter is issued by FHWA that expressly references this device.

#### **Decision**

The following devices are eligible, with details provided in the form which is attached as an integral part of this letter:

- Trinity Slotted Rail Terminal SRT End Terminal Family Ground Strut Modification

#### **Scope of this Letter**

To be found eligible for Federal-aid funding, modified roadside safety devices should meet the crash test and evaluation criteria contained in the National Cooperative Highway Research Program (NCHRP) Report 350. However, the FHWA, the Department of Transportation, and the United States Government do not regulate the manufacture of roadside safety devices. Eligibility for reimbursement under the Federal-aid highway program does not establish approval, certification or endorsement of the device for any particular purpose or use.

This letter is not a determination by the FHWA, the Department of Transportation, or the United States Government that a vehicle crash involving the device will result in any particular outcome, nor is it a guarantee of the in-service performance of this device. Proper manufacturing, installation, and maintenance are required in order for this device to function as tested.

This finding of eligibility is limited to the crashworthiness of the system and does not cover other structural features, nor conformity with the Manual on Uniform Traffic Control Devices.

### **Eligibility for Reimbursement**

FHWA previously issued an eligibility letter for the roadside safety system described in your pending request. Your pending request now identifies a modification to that roadside safety system.

The original roadside safety device information is provided here:

Name of system: Slotted Rail Terminal (SRT)  
Type of system: Terminal  
Date of original request: November 6, 1995  
Date of original FHWA eligibility letter: December 4, 1995  
FHWA Control number: CC31

Name of system: Modified Slotted Rail Terminal (SRT)  
Type of system: Terminal  
Date of original request: November 21, 2000  
Date of original FHWA eligibility letter: December 18, 2000  
FHWA Control number: HSA-1/CC72

The pending modification(s) consists of the following changes:

1. Allow the single 3"x3"x1/4" angle ground strut as a satisfactory replacement for the older SRT strut configurations (i.e., CC-31 & CC-72) and consider it acceptable for use in all versions of the Slotted Rail Terminal (SRT).

FHWA concurs with the recommendation of the accredited crash testing laboratory as stated within the attached form.

### **Full Description of the Eligible Device**

The device and supporting documentation, including reports of the crash tests or other testing done, videos of any crash testing, and/or drawings of the device, are described in the attached form.

### **Notice**

If a manufacturer makes any modification to any of their roadside safety hardware that has an existing eligibility letter from FHWA, the manufacturer must notify FHWA of such modification with a request for continued eligibility for reimbursement. The notice of all modifications to a device must be accompanied by:

- o Significant modifications – For these modifications, crash test results must be submitted with accompanying documentation and videos.
- o Non-signification modifications – For these modifications, a statement from the crash test laboratory on the potential effect of the modification on the ability of the device to meet the relevant crash test criteria.

FHWA's determination of continued eligibility for the modified hardware will be based on whether the modified hardware will continue to meet the relevant crash test criteria.

You are expected to supply potential users with sufficient information on design, installation and maintenance requirements to ensure proper performance.

You are expected to certify to potential users that the hardware furnished has the same chemistry, mechanical properties, and geometry as that submitted for review, and that it will meet the test and evaluation criteria of the NCHRP Report 350.

Issuance of this letter does not convey property rights of any sort or any exclusive privilege. This letter is based on the premise that information and reports submitted by you are accurate and correct. We reserve the right to modify or revoke this letter if: (1) there are any inaccuracies in the information submitted in support of your request for this letter, (2) the qualification testing was flawed, (3) in-service performance or other information reveals safety problems, (4) the system is significantly different from the version that was crash tested, or (5) any other information indicates that the letter was issued in error or otherwise does not reflect full and complete information about the crashworthiness of the system.

#### Standard Provisions

- To prevent misunderstanding by others, this letter of eligibility designated as FHWA control number HSSI/CC-124 shall not be reproduced except in full. This letter and the test documentation upon which it is based are public information. All such letters and documentation may be reviewed upon request.
- This letter shall not be construed as authorization or consent by the FHWA to use, manufacture, or sell any patented system for which the applicant is not the patent holder.
- If the subject device is a patented product it may be considered to be proprietary. If proprietary systems are specified by a highway agency for use on Federal-aid projects: (a) they must be supplied through competitive bidding with equally suitable unpatented items; (b) the highway agency must certify that they are essential for synchronization with the existing highway facilities or that no equally suitable alternative exists; or (c) they must be used for research or for a distinctive type of construction on relatively short sections of road for experimental purposes. Our regulations concerning proprietary products are contained in Title 23, Code of Federal Regulations, Section 635.411.

Sincerely yours,



Michael S. Griffith  
 Director, Office of Safety Technologies  
 Office of Safety

Enclosures

## Request for Federal Aid Reimbursement Eligibility of Highway Safety Hardware

<b>Submitter</b>	<b>Date of Request:</b>	December 18, 2015	<input type="radio"/> New <input checked="" type="radio"/> Resubmission
	<b>Name:</b>	Bret R. Eckert, P.E.	
	<b>Company:</b>	Trinity Highway Products, LLC	
	<b>Address:</b>	3617 Cincinnati Ave., Rocklin, CA 95677	
	<b>Country:</b>	USA	
	<b>To:</b>	Michael S. Griffith, Director FHWA, Office of Safety Technologies	

I request the following devices be considered eligible for reimbursement under the Federal-aid highway program.

System Type	Submission Type	Device Name / Variant	Testing Criterion	Test Level
'CC': Crash Cushions, Attenuators, & Terminals	<input checked="" type="radio"/> Physical Crash Testing <input type="radio"/> Engineering Analysis	SRT-350®	NCHRP Report 350	TL3

By submitting this request for review and evaluation by the Federal Highway Administration, I certify that the product(s) was (were) tested in conformity with the NCHRP Report 350 (Report 350) and that the evaluation results meet the appropriate evaluation criteria in the Report 350.

Identification of the individual or organization responsible for the product:

<b>Contact Name:</b>	Michael Bennett	Same as Submitter <input type="checkbox"/>
<b>Company Name:</b>	Trinity Highway Products, LLC	Same as Submitter <input checked="" type="checkbox"/>
<b>Address:</b>	2525 Stemmons, Freeway, Dallas, TX 75207	Same as Submitter <input type="checkbox"/>
<b>Country:</b>	USA	Same as Submitter <input checked="" type="checkbox"/>

Historical  
Purposes  
Only

Enter below all disclosures of financial interests as required by the FHWA 'Federal-Aid Reimbursement Eligibility Process for Safety Hardware Devices' document.

Trinity Highway Products, LLC ("THP") sponsored crash tests of the SRT system conducted by the Texas A&M Transportation Institute ("TTI") Proving Ground. TTI Proving Ground is an International Standards Organization ("ISO") 17025 accredited laboratory with American Association for Laboratory Accreditation (A2LA) Mechanical Testing certificate 2821.01

The SRT-350 system was designed and developed by engineers who are currently or previously employed by Texas A&M at TTI. The associated United States Patent Office patent numbers are assigned to TAMUS and Exodyne Technologies, Inc. The patent holders of record for the associated patents are listed below:

CRP (Cable Release Post) - US Patent Number 6,729,607: Dean C. Alberson, D. Lance Bullard, Jr., Roger P. Bligh, C. Eugene Buth (TAMUS)

HBA (Breakaway Support Post) -US Patent Numbers 8,038,126 / 6,886,813 / 6,793,204 / 6,793,116 / 6,619,630 / 6,488,268 / 6,398,192: James R. Albritton (Exodyne Technologies, Inc.)

SYTP (Steel Yielding Terminal Post) - US Patent Number 6,902,150: Dean C. Alberson, D. Lance Bullard, Jr., Roger P. Bligh, C. Eugene Buth (TAMUS)

SRT - US Patent Number 5,407,298: Dean L. Sicking, Roger P. Bligh, King K. Mak, Hayes E. Ross, Jr. (TAMUS)

SRT (Slot Guard) - US Patent Number 6,435,761: Roger P. Bligh, King K. Mak, Hayes E. Ross, Jr. (TAMUS)

Angle Strut. US Patent Number 6,783,116; James R. Albritton (Exodyne Technologies, Inc.)

THP pays royalties to TAMUS and Exodyne for sales of the SRT system and parts, pursuant to an executed license agreement. THP is willing to discuss confidential treatment of the content of the license agreement with the FHWA, in a manner that does not cause a breach of the license agreement.

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Research  
and  
Historical  
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## PRODUCT DESCRIPTION

<input checked="" type="radio"/> New Hardware or Significant Modification	<input checked="" type="radio"/> Modification to Existing Hardware	Non-Significant
<p>The original Slotted Rail Terminal (SRT®) as described in Eligibility Letter CC-31 dated December 4, 1995 specified a yoke design ground strut used between posts 1 and 2. A straight flare SRT® with HBA posts was subsequently approved in Eligibility Letter CC-72 on December 18, 2000 and used two, (2), 2"x2"x3/8" angle ground struts. With the approval of the SRT-31° for 31" high guardrail, a single 3"x3"x1/4" angle design ground strut was used between posts 1 and 2 and detailed in Eligibility Letter CC-100 dated August 30, 2007. The single, 3"x3"x1/4" angle ground strut was also used for the SRT-27° in Eligibility Letter CC-101 dated June 3, 2008 and the SRT-M10™ in Eligibility Letter CC-100B dated December 5, 2012.</p> <p>As detailed in the SRT® time line, the single 3"x3"x1/4" angle ground strut has been successfully tested in various SRT® systems under both NCHRP Report 350 and the more severe MASH impact conditions.</p> <p>This request is for the following:</p> <ol style="list-style-type: none"> <li>1. Allow the single 3"x3"x1/4" angle ground strut as a satisfactory replacement for use in the SRT-350° systems.</li> </ol> <p>This modification has been reviewed and justified through engineering analysis and judgment to be non-significant and will have no bearing on the as-tested performance of the system. The Testing Laboratory's signature concurs that these modifications are considered Non-Significant.</p>		

## CRASH TESTING

A brief description of each crash test and its result:

Required Test Number	Narrative Description	Evaluation Results
3-30 (820C)	TTI Test No. 220530-5, Test Date April 29, 1994, Test Report titled "NCHRP Report 350 Compliance Testing of the W-Beam Slotted Rail Terminal", Report No. FHWA-RD-95-. As detailed in the Product Description above, the single 3"x3"x1/4" angle ground strut has been successfully tested in various SRT® systems under both NCHRP Report 350 and the more severe MASH impact conditions. This non-significant modification will have no bearing on the as-tested performance of the system.	PASS
S3-30 (700C)	Not Applicable. Test S3-30 is an optional test and not required for SRT-350° system eligibility.	
3-31 (2000P)	TTI Test No. 220530-10, Test Date June 26, 1995, Test Report titled "NCHRP Report 350 Compliance Testing of the W-Beam Slotted Rail Terminal", Report No. FHWA-RD-95-. As detailed in the Product Description above, the single 3"x3"x1/4" angle ground strut has been successfully tested in various SRT® systems under both NCHRP Report 350 and the more severe MASH impact conditions. This non-significant modification will have no bearing on the as-tested performance of the system.	PASS

Required Test Number	Narrative Description	Evaluation Results
3-32 (820C)	Test 3-32 was waived for the SRT-350° terminal as stated in FHWA Eligibility letter CC-31; In all tests the occupant impact velocities and subsequent ride down accelerations were below the maximum allowable values given in the NCHRP Report 350 evaluation criteria. The non-significant modifications described in the Product Description will have no bearing on the as-tested performance of the system.	Non-Critical, not conducted
S3-32 (700C)	Not Applicable. Test S3-32 is an optional test and not required for SRT-350° system eligibility.	
3-33 (2000P)	Test 3-33 was waived for the SRT-350° terminal as stated in FHWA Eligibility letter CC-31; In all tests the occupant impact velocities and subsequent ride down accelerations were below the maximum allowable values given in the NCHRP Report 350 evaluation criteria. The non-significant modifications described in the Product Description will have no bearing on the as-tested performance of the system.	Non-Critical, not conducted
3-34 (820C)	TTI Test No. 2404SR-5, Test Date August 20, 1987, Test Report titled "NCHRP Report 350 Compliance Testing of the W-Beam Slotted Rail Terminal", Report No. FHWA-RD-95-. As detailed in the Product Description above, the single 3"x3"x1/4" angle ground strut has been successfully tested in various SRT° systems under both NCHRP Report 350 and the more severe MASH impact conditions. This non-significant modification will have no bearing on the as-tested performance of the system.	PASS
S3-34 (700C)	Not Applicable. Test S3-34 is an optional test and not required for SRT-350° system eligibility.	
3-35 (2000P)	TTI Test No. 220536-13, Test Date September 8, 1995, Test Report titled "NCHRP Report 350 Compliance Testing of the W-Beam Slotted Rail Terminal", Report No. FHWA-RD-95-. As detailed in the Product Description above, the single 3"x3"x1/4" angle ground strut has been successfully tested in various SRT° systems under both NCHRP Report 350 and the more severe MASH impact conditions. This non-significant modification will have no bearing on the as-tested performance of the system.	PASS
3-36 (820C)	Not Applicable. Test 3-36 is required for nongating devices and not applicable for gating redirective terminals such as the SRT-350° system.	
S3-36 (700C)	Not Applicable. Test S3-36 is an optional test and not required for SRT-350° system eligibility.	
3-37 (2000P)	Not Applicable. Test 3-37 is required for nongating devices and not applicable for gating redirective terminals such as the SRT-350° system.	
3-38 (2000P)	Not Applicable. Test 3-38 is required for nongating devices and not applicable for gating redirective terminals such as the SRT-350° system.	

Only

3-39 (2000P)	TTI Test No. 220536-14, Test Date September 26, 1995, Test Report titled "NCHRP Report 350 Compliance Testing of the W-Beam Slotted Rail Terminal", Report No. FHWA-RD-95-. As detailed in the Product Description above, the single 3"x3"x1/4" angle ground strut has been successfully tested in various SRT <sup>o</sup> systems under both NCHRP Report 350 and the more severe MASH impact conditions. This non-significant modification will have no bearing on the as-tested performance of the system.	PASS
3-40 (2000P)	Not Applicable. Test 3-40 is for nonredirective, gating devices and not applicable for SRT-350 <sup>o</sup> system eligibility.	
S3-40 (700C)	Not Applicable. Test S3-40 is optional test for nonredirective, gating devices and not applicable for SRT-350 <sup>o</sup> system eligibility.	
3-41 (2000P)	Not Applicable. Test 3-41 is for nonredirective, gating devices and not applicable for SRT-350 <sup>o</sup> system eligibility.	
3-42 (820C)	Not Applicable. Test 3-42 is for nonredirective, gating devices and not applicable for SRT-350 <sup>o</sup> system eligibility.	
S3-42 (700C)	Not Applicable. Test S3-42 is optional test for nonredirective, gating devices and not applicable for SRT-350 <sup>o</sup> system eligibility.	
3-43 (2000P)	Not Applicable. Test 3-43 is for nonredirective, gating devices and not applicable for SRT-350 <sup>o</sup> system eligibility.	
3-44 (2000P)	Not Applicable. Test 3-44 is for nonredirective, gating devices and not applicable for SRT-350 <sup>o</sup> system eligibility.	

Full Scale Crash Testing was done in compliance with NCHRP Report 350 by the following accredited crash test Laboratory. By signature below, the Laboratory agrees in support of this submission that all critical and relevant crash tests for the device listed above were conducted. (cite the laboratory's accreditation status as noted in the crash test reports.):

Testing Laboratory's signature concurs that these modifications are considered Non-Significant.		
Laboratory Name:	Texas Transportation Institute	
Laboratory Signature:	Bligh, Roger P	<small>Digitally signed by Bligh, Roger P DN: postalCode=77843, o=TAMU-SIGN, street=Texas A&amp;M University, st=TX, l=College Station, c=US, cn=Bligh, Roger P, email=rbligh@tamu.edu Date: 2015.12.19 22:33:14 -0500</small>
Address:	Texas A&M Transportation Institute Proving Ground Roadside Safety & Physical Security 3135 TAMU College Station, TX 77843-3135	Same as Submitter <input type="checkbox"/>
Country:	USA	Same as Submitter <input type="checkbox"/>
Accreditation Certificate Number and Dates of current Accreditation period :	A2LA Certificate Number 2821.01 Expires: April 30, 2017	

Submitter Signature\*: Bret Eckert

Digitally signed by  
bret.eckert@prim.net  
DN: cn=bret.eckert@prim.net  
Date: 2015.12.21 07:13:56 -0800

Submit Form

ATTACHMENTS

Attach to this form:

- 1) Additional disclosures of related financial interest as indicated above.
- 2) A copy of the full test report, video, and a Test Data Summary Sheet for each test conducted in support of this request.
- 3) A drawing or drawings of the device(s) that conform to the Task Force-13 Drawing Specifications [[Hardware Guide Drawing Standards](#)]. For proprietary products, a single isometric line drawing is usually acceptable to illustrate the product, with detailed specifications, intended use, and contact information provided on the reverse. Additional drawings (not in TF-13 format) showing details that are relevant to understanding the dimensions and performance of the device should also be submitted to facilitate our review.

FHWA Official Business Only:

Eligibility Letter		AASHTO TF13	
Number	Date	Designator	Key Words

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For  
Research  
and  
Historical  
Purposes  
Only

From: [John L. Moore](#)  
To: [Lorraine J. Hillman](#)  
Subject: RE: CASS S3 Post Sleeve Clamp  
Date: Thursday, December 03, 2015 1:50:44 PM

It's available at A2LA's website.



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### Currently Accredited Organizations

Organizations meeting your criteria who have not yet been renewed through our process can be viewed here

**"Comm Code" Definitions:**

- C1 - Available for Commercial Services
- C2 - Conditionally Available for Commercial Services
- C3 - Not Normally Available for Commercial Services

Type A - third party (commercially available)  
Type B - first and second party (not commercially available)  
Type C - first and second party, and also offering commercially available inspections

[Export Results to PDF](#)

Your query returned 1 records

Certificate#	Organization	Contact	City, State	Country	Phone	Comm Code	Field	Standard	Expiration
989 01	E-TECH Testing Services	Paul Kruse	Rocklin, CA	United States	916 644 9102	C1	Mechanical	ISO/IEC 17025 2005	11/30/2017

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**TRINITY**  
**HIGHWAY**

3617 Cincinnati Ave, Rocklin, CA 95765  
(916) 645-8181 Fax No (916) 645-3495

July 21, 2015

Mr. William P. Longstreet  
Highway Engineer, Safety Design Team  
Office of Safety Technologies, Rm E71-107  
Federal Highway Administration  
U.S. Department of Transportation  
1200 New Jersey Avenue, SE  
Washington, DC 20590

Re: SRT™ Disclosure of Financial Interest, FHWA Review for Eligibility Letter

Mr. Longstreet,

On behalf of Trinity Highway Products, LLC ("THP"), I am responding to your email requesting details of any financial interest that the crash test laboratory, that performed testing, has in the SRT™ End Terminal Family, manufactured by THP.

As noted in THP's request for eligibility for reimbursement under the Federal-aid highway program for this product, the SRT™ End Terminal system was previously deemed eligible by the FHWA pursuant to HNG-14/CC-31, HNG-14/CC-31A, HNG-14/CC-51, HMHS-CC51A, HSA-1/CC72, HSSD/CC-100, HSST/CC-100B, HSST/CC-100C, and HSSD/CC-101.

The SRT™ end terminal technology is the commercial embodiment of intellectual property that is protected by patents that are owned by the Texas A&M University System ("TAMUS"). TAMUS licenses the right to manufacture and sell that commercial embodiment that is commercially known as the SRT™ End Terminal system, to Trinity. THP sponsored certain crash tests of the SRT™ End Terminal system; such tests were conducted at the Texas Transportation Institute ("TTI") Proving Ground on a campus of Texas A&M University. TTI Proving Ground is an International Standards Organization ("ISO") 17025 accredited laboratory with American Association for Laboratory Accreditation (A2LA) Mechanical Testing certificate 2821.01.

TTI conducted full-scale crash testing of the SRT™ End Terminal system, in accordance with the National Cooperative Highway Research Program ("NCHRP") testing criteria, first set forth in the NCHRP Report 230 (198X); then Report 350 (1993); and, per the American Association of State Highway and Transportation Officials ("AASHTO") published testing criteria, as required in the *Manual for Accessing Safety Hardware* (2009) ("MASH").

The SRT™ End Terminal system was designed and developed by research engineers who are (or were employed) by Texas A&M University at its member, TTI.

The patent holders of record for the SRT™ End Terminal systems are Dean L. Sicking, Roger P. Bligh, King K. Mak, and Hayes E. Ross Jr. Sicking and Mak are no longer employed by Texas A&M and Ross has been retired from Texas A&M for many years. The associated United States Patent Office patent numbers (5,407,298; 5,503,495) are assigned to TAMUS. Additionally, as a modification of the SRT™ End Terminal system, the SRT™ End Terminal with Modified Ground Strut patents and financial interests are the same as the SRT™ End Terminal.

THP pays royalties to TAMUS for sales of the SRT™ End Terminal system pursuant to a patent license agreement. TAMUS also received a licensing fee from THP at the time of the license agreement execution.

In accordance with the patent license agreement applicable to this product, the specific details of the agreement are "confidential" and cannot be disclosed. If necessary, THP is willing to discuss confidential treatment of the content of this license agreement with the FHWA, in a manner that does not cause a breach of the license agreement.

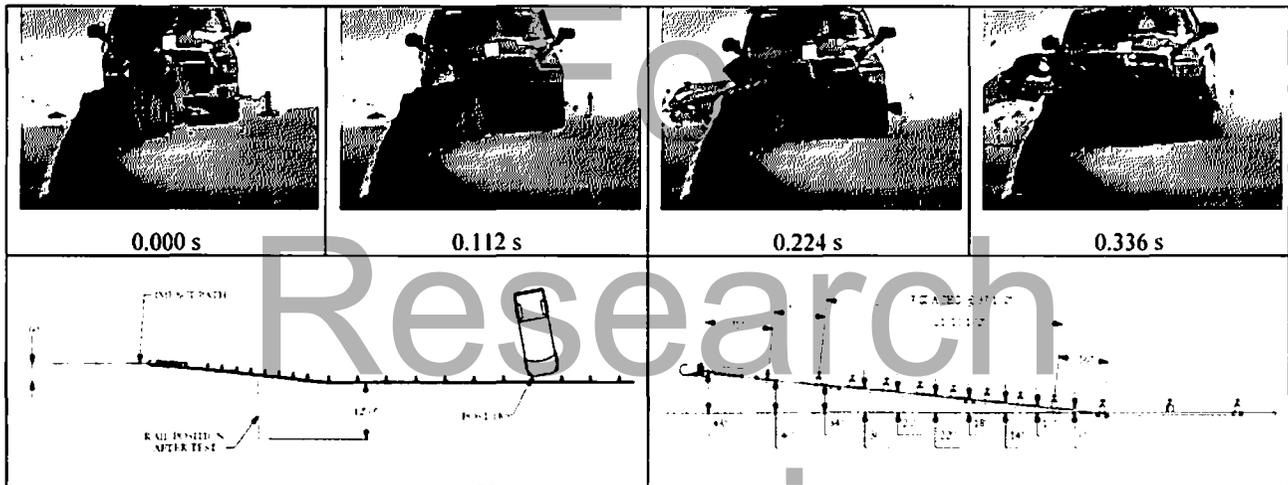
Please advise if further information is required by the FHWA. We look forward to continuing to work with the FHWA in regard to the SRT™ End Terminal and other Roadside Safety Hardware.

Sincerely,

Bret Eckert, P.E.  
Engineering Applications Manager  
Trinity Highway

Office 916-644-9131  
[bret.eckert@trin.net](mailto:bret.eckert@trin.net)

# Archived



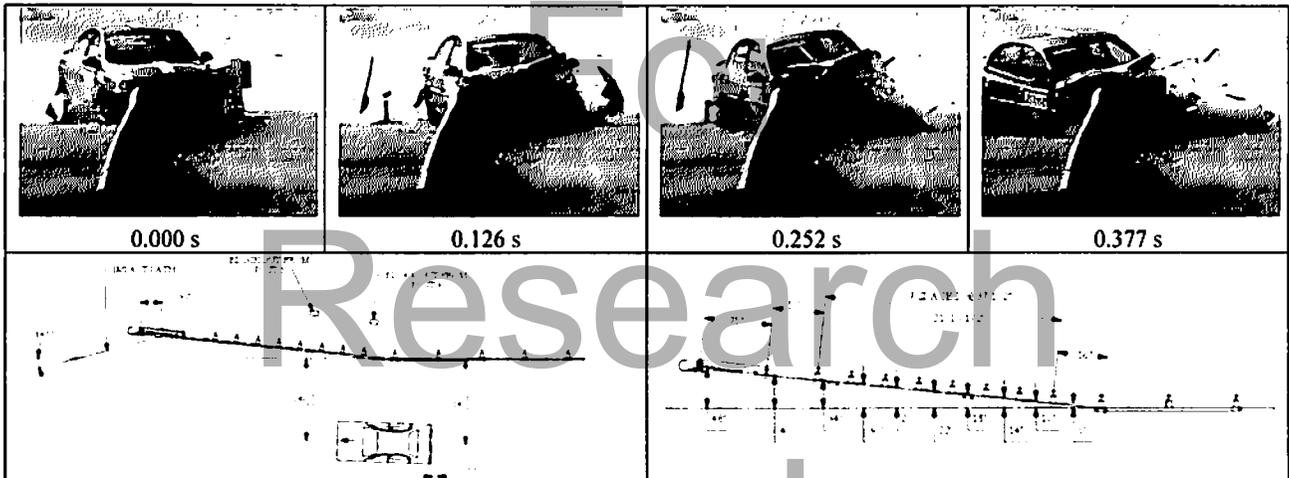
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<b>General Information</b>		<b>Impact Conditions</b>		<b>Post-Impact Trajectory</b>	
Test Agency	Texas Transportation Institute (TTI)	Speed	61.0 mi/h	Stopping Distance	81.0 ft downstrm Against field side
Test Standard Test No.	MASH 3-31	Angle	0.6 degrees		
TTI Test No.	400001-SRT5	Location/Orientation	Nose		
Date	October 21, 2010	Impact Severity	624 kip-ft (-3.5%)		
<b>Test Article</b>		<b>Exit Conditions</b>		<b>Vehicle Stability</b>	
Type	Terminal	Speed	Not obtainable	Maximum Yaw Angle	72 degrees
Name	SRT-MASH	Angle	Not obtainable	Maximum Pitch Angle	5 degrees
Installation Length	131 ft-3 inches	<b>Occupant Risk Values</b>		Maximum Roll Angle	7 degrees
Material or Key Elements	Slotted rail, CRP post 1, SYTP, anchor bracket and cable	Impact Velocity		Vehicle Snagging	No
<b>Soil Type and Condition</b>		Longitudinal	18.0 ft/s	Vehicle Pocketing	No
Standard Soil, Dry		Lateral	2.0 ft/s	<b>Test Article Deflections</b>	
<b>Test Vehicle</b>		<b>Ridedown Accelerations</b>		Dynamic	13.3 ft
Type/Designation	2270P	Longitudinal	11.8 G	Permanent	12.5 ft
Make and Model	2003 Dodge Ram 1500 Pickup Truck	Lateral	7.6 G	Working Width	20.25 ft
Curb	4774 lb	THIV	20.0 km/h	<b>Vehicle Damage</b>	
Test Inertial	5021 lb	ASI	0.50	VDS	12FC4
Dummy	No dummy	<b>Max. 0.050-s Average</b>		CDC	12FCEW4
Gross Static	5021 lb	Longitudinal	-4.7 G	Max. Exterior Deformation	17.0 inches
		Lateral	1.5 G	OCDI	FS0000000
		Vertical	-3.0 G	Max. Occupant Compartment Deformation	0

Figure 5.7. Summary of results for MASH test 3-31 on the SRT-MASH.

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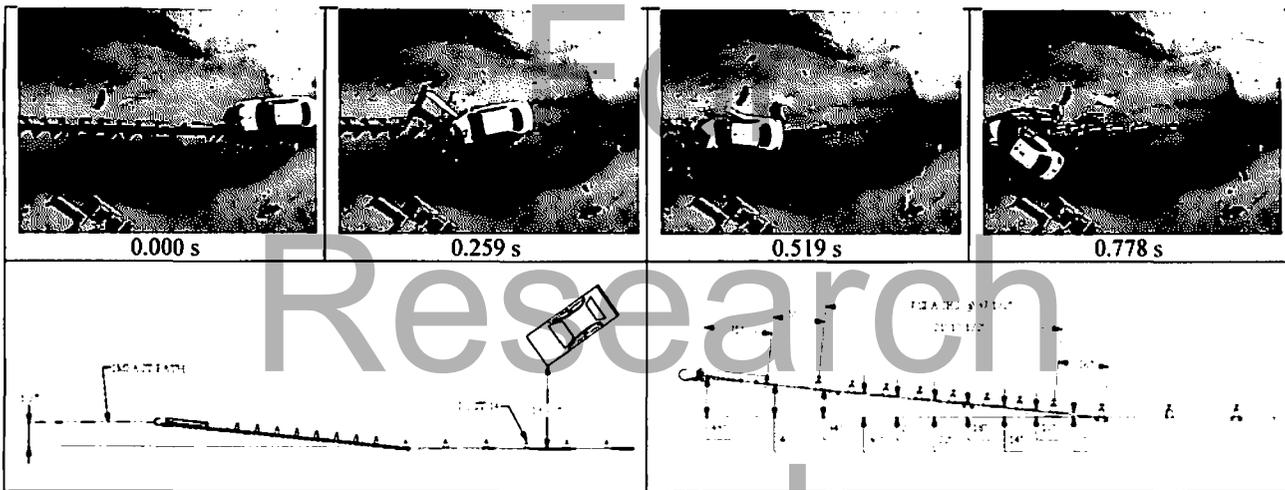
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General Information		Impact Conditions		Post-Impact Trajectory	
Test Agency	Texas Transportation Institute (TTI)	Speed	62.2 mi/h	Stopping Distance	43.8 ft
Test Standard Test No	MASH 3-34	Angle	14.5 degrees		
TTI Test No	400001-SRT4	Location/Orientation	24 inches downstrm post 1		
Date	October 19, 2010	Impact Severity	2126 kip-ft. (-5.5%)		
<b>Test Article</b>		<b>Exit Conditions</b>		<b>Vehicle Stability</b>	
Type	Terminal	Speed	13.3 mi/h	Maximum Yaw Angle	-166 degrees
Name	SRT-MASH	Angle	64.6 degrees	Maximum Pitch Angle	2 degrees
Installation Length	131 ft-3 inches	<b>Occupant Risk Values</b>		Maximum Roll Angle	11 degrees
Material or Key Elements	Slotted rail, CRP post 1, SYTP, anchor bracket and cable	Impact Velocity		Vehicle Snagging	No
Soil Type and Condition	Standard Soil, Dry	Longitudinal	34.8 ft/s	Vehicle Pocketing	No
<b>Test Vehicle</b>		Lateral	13.4 ft/s	<b>Test Article Deflections</b>	
Type/Designation	1100C	<b>Ridedown Accelerations</b>		Dynamic	2.62 ft
Make and Model	2004 Kia Rio	Longitudinal	12.0 G	Permanent	2.62 ft
Curb	2428 lb	Lateral	5.4 G	Working Width	2.62 ft
Test Inertial	2431 lb	THIV	41.1 km/h	<b>Vehicle Damage</b>	
Dummy	174 lb	PHD	13.0 G	VDS	11LFQ6
Gross Static	2605 lb	ASI	1.08	CDC	11FLEW4
		<b>Max 0.050-s Average</b>		Max. Exterior Deformation	15.5 inches
		Longitudinal	-11.9 G	OCDI	FS0000000
		Lateral	3.9 G	Max. Occupant Compartment Deformation	0
		Vertical	3.0 G		

Figure 5.7. Summary of results for MASH test 3-34 on SRT-MASH.

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<b>General Information</b>		<b>Impact Conditions</b>		<b>Post-Impact Trajectory</b>	
Test Agency	Texas Transportation Institute (TTI)	Speed	61.4 mi/h	Stopping Distance	43.75 ft downstrm
Test Standard Test No	MASH Test 3-30	Angle	1.2 degrees		26.3 ft twd field side
TTI Test No	400001-SRT6	Location/Orientation	Nose	<b>Vehicle Stability</b>	
Date	October 29, 2010	Kinetic Energy	305 kip-ft (-2.6%)	Maximum Yaw Angle	151 degrees
<b>Test Article</b>		<b>Exit Conditions</b>		Maximum Pitch Angle	-10 degrees
Type	Terminal	Speed	12.0 mi/h	Maximum Roll Angle	10 degrees
Name	SRT-MASH	Angle	45.4 degrees	Vehicle Snagging	No
Installation Length	131 ft-3 inches	<b>Occupant Risk Values</b>		Vehicle Pocketing	No
Material or Key Elements	Slotted rail, CRP post 1, SYTP, anchor bracket and cable	Impact Velocity		<b>Test Article Deflections</b>	
<b>Soil Type and Condition</b>		Longitudinal	24.3 ft/s	Dynamic	5.3 ft
Standard Soil, Dry		Lateral	1.0 ft/s	Permanent	5.3 ft
<b>Test Vehicle</b>		<b>Ridedown Accelerations</b>		<b>Vehicle Damage</b>	
Type/Designation	1100C	Longitudinal	10.9 G	VDS	12RFQ6
Make and Model	2005 Kia Rio	Lateral	6.6 G	CDC	12FREW4
Curb	2385 lb	THIV	26.9 km/h	Max. Exterior Deformation	12.0 inches
Test Inertial	2423 lb	PHD	11.4 G	OCDI	RF1000100
Dummy	178 lb	ASI	0.66	Max. Occupant Compartment Deformation	6.25 inches
Gross Static	2601 lb	<b>Max. 0.050-s Average</b>			
		Longitudinal	-7.6 G		
		Lateral	-1.9 G		
		Vertical	-3.1 G		

Figure 5.7. Summary of results for MASH test 3-30 on the SRT-MASH.

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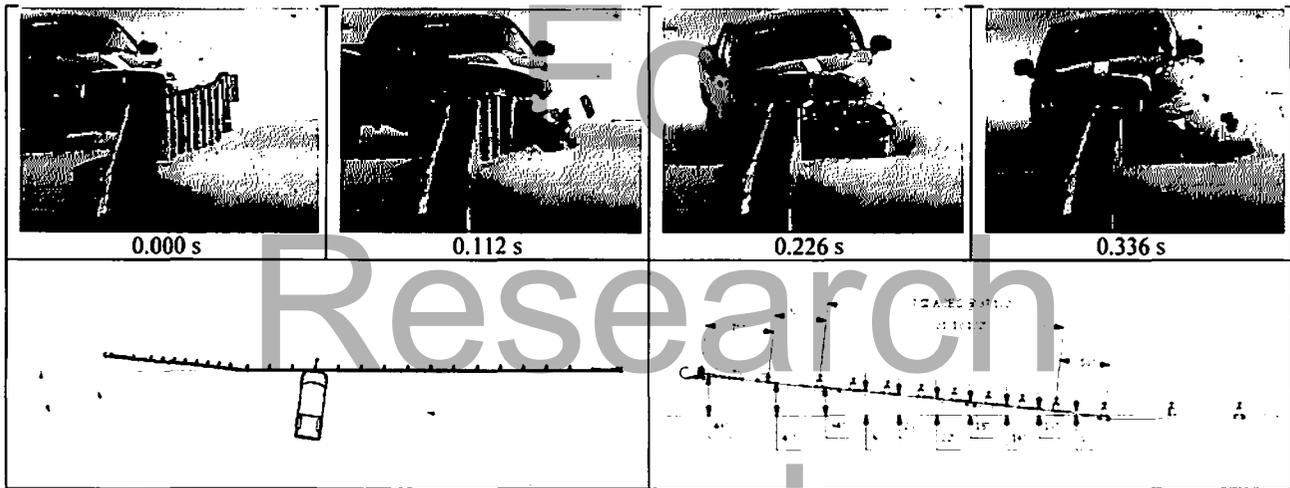
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<b>General Information</b>		<b>Impact Conditions</b>		<b>Post-Impact Trajectory</b>	
Test Agency	Texas Transportation Institute (TTI)	Speed	61.5 mi/h	Stopping Distance	191 ft downstrm
Test Standard Test No	MASH Test 3-32	Angle	5.4 degrees		35 ft twd fold side
TTI Test No	400001-SRT8	Location/Orientation	Nose	<b>Vehicle Stability</b>	
Date	January 21, 2011	<b>Impact Severity</b>	8885 kip-ft	Maximum Yaw Angle	-8 degrees
<b>Test Article</b>		<b>Exit Conditions</b>		Maximum Pitch Angle	14 degrees
Type	Terminal	Speed	40.0 mi/h	Maximum Roll Angle	-32 degrees
Name	SRT-MASH	Angle	2.0 degrees	Vehicle Snagging	No
Installation Length	131 ft-3 inches	<b>Occupant Risk Values</b>		Vehicle Pocketing	No
Material or Key Elements	Slotted rail, CRP post 1, SYTP, anchor bracket and cable	Impact Velocity		<b>Test Article Deflections</b>	
<b>Soil Type and Condition</b>	Standard Soil, Dry	Longitudinal	24.6 ft/s	Dynamic	4.0 ft
<b>Test Vehicle</b>		Lateral	3.3 ft/s	Permanent	4.0 ft
Type/Designation	1100C	<b>Ridedown Accelerations</b>		Working Width	
Make and Model	2005 Kia Rio	Longitudinal	5.0 G	<b>Vehicle Damage</b>	
Curb	2385 lb	Lateral	5.6 G	VDS	12FD6
Test Inertial	2412 lb	THIV	27.3 km/h	CDC	12FDEW4
Dummy	172 lb	PHIV	7.4 G	Max. Exterior Deformation	7.0 inches
Gross Static	2584 lb	ASI	0.64	OCDI	FS0000000
		Max. 0.050-s Average		Max. Occupant Compartment Deformation	0
		Longitudinal	-6.7 G		
		Lateral	1.8 G		
		Vertical	-5.2 G		

Figure 5.7. Summary of results for MASH test 3-32 on SRT-MASH.

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General Information		Impact Conditions		Post-Impact Trajectory	
Test Agency	Texas Transportation Institute (TTI)	Speed	62.4 mi/h	Stopping Distance	81.3 ft
Test Standard Test No	MASH Test 3-35	Angle	24.3 degrees		
TTI Test No	403371-SRT3	Location/Orientation	Post 4		
Date	2010-10-04	Impact Severity	3507 kip-ft (-4.9%)		
Test Article		Exit Conditions		Vehicle Stability	
Type	Terminal	Speed	Not obtainable	Maximum Yaw Angle	-43 degrees
Name	SRT-MASH	Angle	Not obtainable	Maximum Pitch Angle	-5 degrees
Installation Length	137 ft-6 inches			Maximum Roll Angle	9 degrees
Material or Key Elements	Slotted rail, CRP post 1, SYTP, anchor bracket and cable			Vehicle Snagging	No
				Vehicle Pockting	No
Soil Type and Condition		Occupant Risk Values		Test Article Deflections	
	Standard Soil, Dry	Impact Velocity		Dynamic	3.8 ft
		Longitudinal	21.6 ft/s	Permanent	3.8 ft
		Lateral	16.7 ft/s	Working Width	4.0 ft
Test Vehicle		Ridedown Accelerations		Vehicle Damage	
Type/Designation	2270P	Longitudinal	8.1 G	VDS	11LF05
Make and Model	2003 Dodge Ram 1500 Pickup	Lateral	5.2 G	CDC	11FLEW4
Curb	4712 lb	THIV	29.5 km/h	Max. Exterior Deformation	16.0 inches
Test Inertial	4948 lb	PHD	9.4 G	CCDI	LF0000000
Dummy	No dummy	ASI	0.77	Max. Occupant Compartment Deformation	1.5 inches
Gross Static	4948 lb				
		Max. 0.050-s Average			
		Longitudinal	-6.7 G		
		Lateral	5.1 G		
		Vertical	1.6 G		

Figure 5.7. Summary of results for MASH test 3-35 on SRT-MASH.

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